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Committee on the Peaceful Uses of Outer Space

International cooperation in the peaceful uses of outer space: activities of Member States

Note by the Secretariat*

Addendum

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* The present document contains replies received from Member States between 1 December 2000 and 16 January 2001.

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I. Introduction

1. In the report of its forty-third session,[1] the Committee on the Peaceful Uses of Outer Space agreed that the Scientific and Technical Subcommittee should consider an agenda item entitled "General exchange of views and introduction to reports submitted on national activities". In its resolution 54/67 of 6 December 1999, the General Assembly endorsed the recommendation of the Committee[2] that the Secretariat invite Member States to submit annual reports on their space activities. In addition to information on national and international space programmes, the reports could include information on spin-off benefits of space activities and other topics requested by the Committee and its subsidiary bodies.

2. Information received by Member States as at 30 November 2000 is contained in the note by the Secretariat of 4 December 2000 (A/AC.105/752). The present document contains information submitted by Member States between 1 December 2000 and 16 January 2001.

II. Replies received from Member States

Germany

Space activities in Germany are described in the Annual Report of the German Aerospace Centre (DLR), to be distributed at the thirty-eighth session of the Scientific and Technical Subcommittee, from 12 to 23 February 2001.

Indonesia

A. Introduction

1. Indonesia is a sprawling archipelago with more than 17,000 islands, large and small, some adorned with volcanic mountains, others flat and marshy, spreading out along one eighth of the Equator and covering an area of some 1.9 million sq km of land, 3.1 million sq km of territorial sea and a 2.7 million sq km exclusive economic zone. With all its specific conditions and its geographical location, Indonesia is the only maritime country in the world with a unique behaviour that affects the global climate.

2. Owing to its specific conditions and geographical location, Indonesia views space technology and its applications as a powerful and efficient tool that can make a significant contribution to solving the multitude of development problems confronting the country. This was the main reason why Indonesia embarked on its space activities in the early 1960s. The emphasis of national space activities relevant to national development has been placed on the application of space technology to enhance the welfare of all Indonesian people and on other space-related efforts required for the sustainability of such activities.

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[1] *Official Records of the General Assembly, Fifty-fifth Session, Supplement No. 20* (A/55/20), para. 119.

[2] Ibid., *Fifty-fourth Session, Supplement No. 20 and corrigendum* (A/54/20 and Corr.1), para. 119.

B. Organization

3. Space-related activities in the country are conducted by various departments and agencies. The National Institute of Aeronautics and Space (LAPAN) acts as a national focal point in conducting research and development related to the peaceful uses of outer space. LAPAN is directly responsible to the President of Indonesia, while its activities are technically coordinated by the Ministry of State for Research and Technology. The National Space Policy and Plan are formulated by the National Council for Aeronautics and Space of the Republic of Indonesia. The Council, chaired by the President of Indonesia, also acts as the highest coordination body for all space activities in the country.

C. Activities and accomplishments

1. Telecommunications

4. At present, six satellites—two satellites of the Palapa B series, one of the Palapa C series, Indostar-1 (also known as Cakrawarta-1), Telkom-1 and Garuda-1—are being operated by state-owned and private companies for the purpose of fixed telecommunications, broadcasting and mobile telecommunications. Garuda-1, launched in February 2000, is one of the most powerful geosynchronous satellites ever built for commercial use for global mobile personal telecommunications. The service area of Garuda-1 extends from India and Pakistan in the west to Papua New Guinea and the Philippines in the east, and from China and Japan in the north down to Indonesia in the south. Garuda-1 is owned jointly by PT Pacific Satelit Nusantara, the first private satellite telecommunication company in Indonesia, Lockheed-Martin Global Telecommunications of the United States of America, the Philippines Long Distance Telephone Company and Jasmine International Public Company Limited of Thailand.

5. The operation of telecommunications satellites, which has made a big leap in serving the country's telecommunications needs, has also driven the growth of various telecommunications industries in Indonesia, such as transmission equipment, cable and exchange/switching industries. The initiative to launch telecommunications satellite systems not only supports telecommunications infrastructure development, but also creates strategic value in social, economic, educational and cultural aspects.

2. Remote sensing applications: Earth and the environment

6. Many organizations, institutes and industries in Indonesia are active in remote sensing. Based on its functions, LAPAN acts as the national focal point in research and development of the utilization of remote sensing satellite data. In that context, LAPAN has been operating the remote sensing ground station system as well as other facilities for remote sensing satellite data applications. Other national agencies, among them the National Coordination Agency for Surveying and Mapping (Bakosurtanal), the Meteorological and Geophysical Agency (BMG), the Agency for the Assessment and Application of Technology (BPPT), the Indonesian Institute of Sciences (LIPI), the Ministry for Public Works, the Ministry for Forestry and the Ministry of State for Life Environment, have also installed data-processing

facilities corresponding to their needs. Institutes of higher learning, including the University of Gadjah Mada (UGM) and Bogor Agriculture Institute, have established and carried out an education and training programme in remote sensing aimed at developing students as both scholars and skilled practitioners in the applications of remote sensing satellite data. A number of private companies have also been involved in providing satellite data and the involvement of such companies will continue to increase.

7. Starting in the year 2000, LAPAN has upgraded the existing multi-mission ground receiving station located at Parepare, south Sulawesi. The upgrading was completed at the end of October 2000 and the station is now able to acquire Landsat 7 data.

8. In furtherance of remote sensing activities in Indonesia, LAPAN has been conducting research and development in remote sensing technology and applications as well as training and education for user agencies. In the field of remote sensing technology, attention is given mostly to the ground segment. Some activities that have been performed by LAPAN include (a) engineering design of an acquisition system for a low-bit-rate satellite; (b) designing and establishing a PC-based image-processing prototype (32 bits for a single user and 64 bits for multiple users); and (c) study of future satellite technology trends and direct data capture.

9. Applications of remote sensing data in Indonesia are based on satellite imagery of the Earth and the environment acquired by LAPAN ground stations. Data or information derived from satellite imagery have been used for various scientific and operational applications such as (a) inventory of irrigated rice fields; (b) forest mapping and monitoring; (c) mangrove forest inventory; (d) coral reef mapping; (e) mapping of sea surface temperature; (f) forest fire detection and monitoring; (g) drought monitoring; (h) Inter-Tropical Convergence Zone monitoring and cloud cover mapping; (i) outgoing long-wave radiation mapping and monitoring; (j) flood monitoring and flood susceptibility assessment; and (k) identification of potential fishing zones.

3. Research and observations of the atmosphere and ionosphere

10. The main institute undertaking activities related to research and observations of the atmosphere and ionosphere/upper atmosphere is LAPAN. Its research and observations are intended to enhance the use of existing space technology for various fields of application as well as to understand the natural phenomena and specifications of the atmosphere and ionosphere/upper atmosphere in relation to Indonesian climate prediction and environmental conditions.

(a) Research and modelling of the Indonesian climate

11. The climate research programme in Indonesia is intended to provide scientific insight into the causes and effects of changes in and variability of climate systems on global, regional and local scales. It also serves as a basis for developing tools for assessing options for responding to climate change and variability. With the increase in understanding of those systems and their feedback mechanisms, the scientific outcomes would certainly provide increasingly valuable input to support national, regional and international policy decisions, as well as input for evaluating the impact and effectiveness of those decisions.

12. Activities related to research and modelling of the Indonesian climate are performed within five programmes:

(a) *Atmospheric processes*. The atmospheric processes programme aims to improve knowledge of dynamic systems, radiation balance (the interaction of radiation with clouds and the Earth's surface and the way in which water vapour affects climate), cloud formation and cloud cover, precipitation, transpiration and evaporation, the hydrological cycle, atmospheric dynamics on micro-, meso- and macro-scales, ocean-atmosphere interactions and the role of the equatorial atmosphere;

(b) *Biogeochemical processes (including atmospheric pollution)*. The biogeochemical processes programme is studying many aspects of greenhouse gases as well as factors that influence urban and regional air quality, focusing on identifying sources of pollution and studying the way in which it is formed, transported and dispersed. Based on a model constructed by the Australian Commonwealth Scientific and Industrial Research Organization (CSIRO), a Lagrangian atmospheric dispersion model has been developed that can be used to describe dispersion of pollution in a number of cities in Indonesia;

(c) *Solar-terrestrial relationships*. Research on solar-terrestrial relationships focuses on the effects of solar variability on the atmosphere, biosphere and the Earth's surface and on the response of the middle atmosphere to lower- and upper-forcing and to mass and energy transfer in the middle and upper atmosphere. The programme also gives attention to the physics of the Sun as the main source of the energy and disturbances in the Earth's atmosphere;

(d) *Climate modelling, simulation, prediction and scenarios*. The climate modelling programme is aimed at developing powerful computer climate models of the atmosphere. Ocean-atmosphere-land-biosphere interactions are formulated and integrated into models. Those models are used to investigate climate variability, climate change associated with an enhanced greenhouse effect and the likely impact on climate change and variability. LAPAN recently installed a range of climate modelling facilities, which include an atmospheric and ocean global circulation model and a limited area model developed by the CSIRO Division of Atmospheric Research. The model is the basis for studies, assessment and development of an appropriate model in accordance with Indonesian characteristics;

(e) *Climate data and information system*. A large amount of climate-related data is obtained by a number of institutes in Indonesia (mainly BMG, LAPAN, BPPT, Bakosurtanal and LIPI), as well as by a number of foreign institutions. A system that links and integrates the existing database is now under development.

(b) Research and observation of the ionosphere and upper atmosphere

13. Indonesia is located within the ionospheric equatorial anomaly region, which provides a good opportunity to investigate the behaviour of low-latitude ionospheric phenomena. Ionospheric research is important not only for understanding the physics of the upper atmosphere, but also for ionospheric radio propagation. For those purposes, an ionospheric sounding network consisting of six digital ionosondes has been established in Indonesia. Digital ionosonde data provided every minute with high time-resolution digital ionograms will be available. Those high-resolution ionograms will provide useful information on ionospheric dynamics

and ionospheric irregularities and for high-frequency (HF) radio communication. Ionospheric vertical sounding observations covering one solar cycle are used to develop a model of HF radio communication prediction. Through collaboration between Australia and Indonesia, the accuracy of frequency prediction has been improved using real-time frequency management. That activity is supported by an oblique sounding system.

14. To investigate varying phenomena such as the effects of geomagnetic storms and magnetic micro-pulsations on the ionosphere, a network of geomagnetic observations consisting of fluxgate magnometers has been established in Indonesia. Variations in the Earth's magnetic field and geomagnetic pulsations can now be routinely monitored. Indonesia is at present participating in a western Pacific project to develop a forecasting capability for the occurrence and severity of equatorial spread-*F* (ESF) on a day-to-day timescale. The goal of the western Pacific project is to obtain a comprehensive set of measurements, including the electric field and the plasma density distribution along a magnetic meridian plane, in both hemispheres.

15. In order to study the effect of the ionosphere on the reception of signals from satellites, total electron content and scintillation data deduced from Global Positioning System (GPS) and navy navigational satellite system (NNSS) satellites have been used with applications to the physical modelling of total electron content and scintillation effects. The signals from GPS and NNSS satellites are being used to provide group delay and differential phase information as well as the total electron content and scintillation.

16. Through collaboration since 1995 between Australia, Indonesia and Japan, a multi-frequency radar (MFR) has been established at Pontianak (0.03° S, 109.33° E) for measurements of atmospheric dynamics in the equatorial mesosphere and lower thermosphere. Recent studies revealed that a better understanding of the global structure of atmospheric dynamics requires more information on subjects such as momentum flux and horizontal motion of the middle thermosphere. To that end, the MFR will be replaced with a new MFR located in the same place. In addition, airglow imager observations have been conducted since October 2000 at Tanjungsari (6.90° S, 107.50° E), West Java.

4. Global positioning system applications

17. Since 1996, GPS has been the tool in the re-establishment of the national Geodetic Datum and Reference System. Indonesia adopted WGS-84 reference ellipsoid parameters for the new Indonesian national spheroid to replace GRS-67.

18. Up to October 2000, Indonesia, through Bakosurtanal, had established 550 geodetic reference points of zero- and first-order specification, while more than 10,000 geodetic control points of second- and third-order specification had been established by the National Land Agency in cooperation with Bakosurtanal, Bandung Institute of Technology and UGM.

19. From 1996 to 1999, six differential GPS permanent tracking stations had been used for the operation of the digital marine resource mapping project.

20. For the purpose of precise geodetic and geophysical application, Bakosurtanal established six permanent geodetic GPS stations located in Cibinong, Medan,

Parepare, Tolitoli, Kupang and Biak. Those stations are part of a total of 12 stations designed to constitute the Indonesian Permanent GPS Station Network (IPGSN). The development and operation of the network is supported by the Scripps Institution of Oceanography (SIO) of the University of California at San Diego, United States of America, the École normale supérieure (ENS), Paris, and Delft University of Technology (DUT) in the Netherlands. The Cibinong and Medan stations are also part of the Indonesian contribution to the International GPS Geodynamics Services of the International Association of Geodesy programme.

21. At the end of 2000, Bakosurtanal will establish a high-rate GPS permanent tracking station in Yogyakarta for the purpose of monitoring the orbit of the challenging mini-satellite payload (CHAMP) mission as well as for monitoring Merapi volcanic activities. The plan will be supported by the GeoForschungsZentrum (GFZ) of Germany and will be operated by the UGM Department of Geodesy.

22. Regarding GPS applications for geodynamic studies in Indonesia, in particular plate tectonic motion, Bakosurtanal and related agencies of Indonesia, in cooperation with the Bundesamt für Kartographie und Geodäsie and GFZ of Germany, SIO and Rensselaer Polytechnic Institute of the United States, ENS of France, DUT of the Netherlands, the Australian Surveying and Land Information Group and the University of New South Wales of Australia, the Department of Standards Malaysia and the University of Technology Malaysia, the Royal Survey of Thailand, the National Mapping and Resource Information Authority of the Philippines, Nanyang Technological University of Singapore, the Survey Department of Viet Nam and the Department of Public Works of Brunei Darussalam, have carried out several GPS campaigns in the south-east Asian region as well as in the Indonesian region. Target areas include the Sumatran Fault, the Sunda Strait, the Java Subduction Zone, the Sulawesi Triple Junction, the Flores Fault and the Sorong Fault.

5. Space technology development

23. Activities related to space technology development have stressed indigenous design and development of systems and/or subsystems. These include systems for guidance and control, sounding rocket mechanisms and structures, development and testing of propellant raw materials and solid propellant, space vehicle payload telemetry technology, data communication technology and low-Earth orbit tracking technology. LAPAN, as the main institute in the country carrying out space technology development, is now developing standardized rockets for the purpose of research dealing with middle and upper atmosphere physics.

24. Space technology development will accelerate within available resources in order to catch up or at least keep pace with the fast-growing world of space. In that regard, Indonesia among others is now giving attention to the possibility of small satellite development intended for various applications.

6. Studies of socio-economic and legal aspects of space activities

25. Studies concerning various aspects such as the socio-economic and legal aspects of space activities in the national and international spheres have been taking place for several years. As a result of the studies, among other things, Indonesia has

ratified the Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space (resolution 2345 (XXII), annex), the Convention on International Liability for Damage Caused by Space Objects (resolution 2777 (XXVI), annex) and the Convention on Registration of Objects Launched into Outer Space (resolution 3235 (XXIX), annex). Indonesia has initiated the process of ratification of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (resolution 2222 (XXI), annex), which requires the approval of the Parliament, something that is yet to be obtained. At the executive level, however, the process is almost complete.

7. Regional and international cooperation

26. Regional and international cooperation has been the hallmark of the Indonesian space programme, which endeavours to enhance cooperation with several space agencies and institutions around the world. Indonesia, within available resources, always participates in all main events and meetings of regional and international organizations and initiatives, among others the Committee on the Peaceful Uses of Outer Space, the Regional Space Applications Programme for Sustainable Development (RESAP) in Asia and the Pacific, European Community/Association of South-East Asian Nations (ASEAN) projects, the Subcommittee on Space Applications of the ASEAN Committee on Science and Technology, the Asia-Pacific Regional Space Agency Forum, the Asia-Pacific Network for Global Change Research, the regional Centre for Space Science and Technology Education in Asia and the Pacific, the South-East Asia Regional Committee for the Global Change System for Analysis, Research and Training, the International Geosphere-Biosphere Programme, the Scientific Committee on Solar-Terrestrial Physics, the International Astronautical Federation and the Committee on Space Research.

27. Having been in existence since 1995, RESAP has implemented various activities such as training courses. Since 1995, Indonesia, through Bakosurtanal and the UGM Laboratory for Remote Sensing (PUSPICS) and supported by the United Nations Development Programme, has organized annual medium-term training courses on sustainable land use planning. The training courses have focused on the application of remote sensing data and geographic information systems (GIS) in land use planning. During 2000, Bakosurtanal and PUSPICS/UGM jointly hosted the following training courses: (a) Training Course on the Integrated Use of Remote Sensing and Geographical Information Systems for Coastal Management, held from 28 February to 4 March 2000; and (b) Training Course on the Integrated Use of Remote Sensing and Geographical Information Systems for Land Use Planning, held from 13 November to 13 December 2000. As of 2000, participants from 25 countries of Asia and the Pacific as well as Africa had been trained in Bakosurtanal and PUSPICS/UGM. After receiving approval from the Government of Indonesia, a similar training course is expected to be held in Indonesia in 2001.

Pakistan

A. Provision of satellite data and hardware and software to user institutions in developing countries to initiate or strengthen pilot projects that use Earth observation data for protecting the environment and management of natural resources

1. The Pakistan Space and Upper Atmosphere Research Commission (SUPARCO), as the national coordinator for remote sensing activities in Pakistan, has played and continues to play a pivotal role in promoting the use of satellite remote sensing technology in the country. SUPARCO scientists have carried out a large number of research/demonstration studies addressing a wide variety of resource and environmental problems using satellite remote sensing and geographic information system (GIS) technologies.

2. Since the establishment of a satellite ground station in 1989 in Pakistan, SUPARCO is regularly providing satellite remote sensing data as well as analysis and interpretation services to more than 100 national and international user agencies. A fair amount of remote sensing data prior to the establishment of the satellite ground station is also available in the archives of SUPARCO as historical records data.

3. SUPARCO facilities, such as hardware and software for satellite remote sensing data processing and GIS database development, are available under collaborative arrangements for national user organizations for applications in their projects.

B. Development and implementation of a training module on the use of satellite communications for distance education, telemedicine and tele-health applications

4. Satellite-based telecommunication offers inherent advantages such as distance insensitivity, instantaneous connection, access to remote areas and communities and point-to-multipoint access. For that reason, it has been effectively utilized for new and diverse services and applications such as distance education, telemedicine and tele-health.

1. Distance education

5. The development and maintainance of a good and sophisticated educational institution as well as a qualified teaching cadre is difficult and very costly. However, transmission of training and educational material and conversations with instructors via satellite telecommunication has removed all the difficulties of inaccessibility to remote and isolated communities, the long delays in dispatching and receiving materials and the costs involved. SUPARCO has been contributing actively by developing as well as implementing training modules for distance education. In that regard, SUPARCO developed a store-and-forward communication experiment (SAFE) for exchange of messages and information between any two remote locations. The module was flown on board the Commission's first experimental satellite, BADR-1, launched in July 1990. Small ground terminals were also developed to track the satellite and transmit messages. To demonstrate and to

develop awareness among teachers and students in educational institutions, several open houses, seminars and workshops were organized on the usefulness of the system, especially for distance messaging and education. SUPARCO is also extending cooperation to higher educational institutions by arranging specialized courses on satellite-based telecommunications and their applications on a regular basis. Such training courses are conducted at Karachi and Lahore Universities. In addition, SUPARCO has established an Aerospace Institute in Islamabad for regular training and education of scientists and engineers in the fields of space science and space technology, including telecommunications, information technology and their applications.

6. SUPARCO has also developed an improved version of the SAFE module to be flown on board its second BADR satellite, scheduled for launching in the first quarter of 2001. Small ground terminals are also being developed for participation of the national scientific community and educational institutions in the experiment.

2. Telemedicine/tele-health

7. Through central or regional hook-ups, even the most remote areas can benefit from the medical expertise normally available only in the large urban centres. Through satellite-linked connections remote areas can access support centres where symptoms can be diagnosed and treatment prescribed. The system can make a major contribution to overcoming the shortage of qualified medical professionals. SUPARCO has been arranging short visits of medical students and teachers to its research and development establishments on a regular basis to create awareness of telemedicine and tele-health applications of satellite communications in Pakistan.

Republic of Korea

A. Introduction

1. The main objective of the present annual report is to review briefly the space activities of the Republic of Korea in 2000, including those in the area of space science and technology. The highlight of space activities in 2000 was that the first Korean remote sensing satellite KOMPSAT-1, in successful operation, has begun to provide services for local and overseas users.

2. The Korean space programme covers space communications, satellite development and Earth observation. The key areas of research in space applications, other than space communications, are satellite remote sensing, geographic information systems (GIS) and the Global Positioning System (GPS). Current research activities are undertaken by various organizations, including research institutes and universities. At the national level, the Ministry of Science and Technology, the Ministry of Commerce, Industry and Energy and the Ministry of Information and Communication play central roles in coordinating and implementing space technology policy as well as in funding space development research. At the local level, local authorities conduct research based on satellite information for the development of their communities in the areas of the environment, water resources, forests, fisheries and industry.

B. Satellite programme

3. A new space era has opened recently for the country with ambitious planning for space development. In 2000, four satellites, including two geostationary orbit (GEO) communication satellites, have been successfully operated through the implementation of their missions.

1. KOMPSAT programme

4. The Korea Aerospace Research Institute (KARI) has been developing Korea Multi-purpose Satellite-1 (KOMPSAT-1 or Arirang), a small 510-kg Earth observation satellite with an orbital altitude of 685 km, for five years, together with TRW Inc. of the United States of America. On 20 December 1999, KOMPSAT-1 was successfully launched from Vandenberg Air Force Base, California, United States.

5. KOMPSAT-1 has three mission payloads, a high-resolution electro-optical camera (EOC), an ocean scanning multi-spectral imager (OSMI) and a space physics sensor (SPS). The main mission payload, the EOC, collects panchromatic imagery with a ground sample distance (GSD) of 6.6 metres and a swath width of 17 km by pushbroom scanning. Using the roll-tilt capability of KOMPSAT-1, the EOC can take stereo images that enable the production of digital elevation maps, which can then be used as basic materials for GIS and land development programmes. The primary mission of OSMI is to conduct worldwide ocean colour monitoring and environmental monitoring. It will generate 6-band ocean colour images with a 800-km swath and 1-km GSD by whiskbroom scanning. OSMI is designed to provide in-orbit spectral band selectivity in a spectral range from 400 to 900 nanometres through ground command. SPS consists of a high-energy particle detector (HEPD) and an ionosphere measurement sensor (IMS). The HEPD is intended to characterize the low-altitude high-energy particle environment, while IMS measures densities and temperatures of electrons in the ionosphere. The Republic of Korea started releasing its data for local and overseas users on 1 June 2000 and the data can be used for peaceful purposes.

6. KOMPSAT-1 was the first satellite of the Government of the Republic of Korea for Earth observation. From the success of the KOMPSAT-1 project, the Republic of Korea has laid the national infrastructure related to Earth observation by satellite. Seven companies in the Republic of Korea have been able to acquire the facilities and experts to manufacture Earth observation satellites. KARI has developed the Satellite Integration and Test Centre (SITC), which has the capability to integrate and test 1,000 kg-class satellites. Test facilities at SITC include a 3.6-m thermal vacuum chamber, a 150 kN-class vibration tester and electromagnetic interference (EMI)/electromagnetic compatibility (EMC) test facilities. To control and operate KOMPSAT-1, KARI has also developed a ground station, together with the Electronics and Telecommunications Research Institute, in the Republic of Korea. The ground station facilities consist of S-band and X-band antennas, data storage and processing equipment, satellite operation software, mission analysis and planning software and a satellite simulator. Using the ground station, the satellite image data from KOMPSAT-1 were successfully downloaded and showed the beautiful shape of the Korean peninsula.

7. KARI is now developing KOMPSAT-2, a 700-kg Earth observation satellite with an orbital altitude of 500-800 km. Its orbit will be similar to that of KOMPSAT-1. The main mission of KOMPSAT-2 is GIS image acquisition (panchromatic and multi-spectral) for the Korean region. A multi-spectral camera will be the main payload of KOMPSAT-2, which is now being developed jointly with Elbit System Ltd. in Israel. The camera will be capable of taking photostatic images with 1-m panchromatic visible resolution and 4-m multi-spectral resolution.

2. KAISTSAT-4 programme

8. The fourth small satellite of the Republic of Korea, KAISTSAT-4, is under development under the responsibility of the Satellite Technology Research Centre of the Korea Advanced Institute of Science and Technology (KAIST). The KAISTSAT-4 programme commenced in October 1998 and will be completed in mid-2002.

9. KAISTSAT-4 has been assigned several missions for applications of space science and technology. It carries various space science observation and space engineering test payloads. The aim of its space science missions is to investigate the evolution and spatial distribution of the hot interstellar medium by performing spectral diagnostics in the far ultraviolet range. The space physics of the Earth's polar region will also be studied by simultaneously measuring the populations of charged particles precipitating into the Earth's upper atmosphere. KAISTSAT-4 will deploy a satellite-based data collection system to carry out environment monitoring, wildlife tracking and transportation monitoring. The data collection system is being developed jointly through international cooperation with Australia. One of the main missions of KAISTSAT-4 will be the development and in-orbit testing of a precision star sensor necessary for precise attitude control, which is essential for high-resolution Earth and space observation.

3. KOREASAT programme

10. At the end of 2000, a new broadcasting law, the Integrated Broadcasting Act, was passed by the Culture-Tourism Committee of the National Assembly, and commercial broadcasting services via satellite have commenced in the Republic of Korea under the Act. The Republic of Korea will have high-quality television, telecommunications and Internet service lines using communication satellite technology. The new Act encourages many companies to participate in the Internet service industry via satellite. As the demand on transponders increases, KOREASAT-2 and -3 will play key roles in the future market.

11. Korea Telecom, the owner and operator of KOREASAT-1, has sold the satellite, which has outlived its predicted service life, to Alcatel.

12. The Republic of Korea is considering developing communication satellites additional to the KOREASAT programme. A feasibility study on the local development of a new communication satellite was concluded with the requirement of a spacecraft with a weight of 2,000 kg and power of 3 kW.

C. Space technology applications and space science

1. Space technology applications

13. KOMPSAT-1 has been promoting research and utilization activities in the Republic of Korea remote sensing sector using its data distribution. The following activities have been conducted:

(a) Developing data policy for KOMPSAT-1 data users:

(i) Development of basic plans for data application;

(ii) Development of a KOMPSAT-1 operation plan;

(iii) Identification of methods of data distribution to public and commercial users;

(iv) Development of a pricing policy and related policies;

(b) Forming KOMPSAT-1 data user groups:

(i) Establishing a data distribution system;

(ii) Holding a KOMPSAT-1 workshop for users;

(iii) Contracting with a marketing agency, the Korea Aerospace Industry Ltd. (KAI), for commercial and overseas users;

(c) Establishing an interface between the users and KARI:

(i) Development of a Web site application for KOMPSAT-1 users (see http://kompsat.kari.re.kr and http://krps.kari.re.kr);

(ii) Provision of offices and a software system for external users.

14. The policy on data requires a basic strategy for KOMPSAT-1 data application. The policy's basic objectives are to maximize the use of KOMPSAT-1 data and stimulate a balanced development of public, academic and commercial applications. Domestic user groups can utilize KOMPSAT-1 data for non-commercial, public and research purposes. User groups have to register the name of their organizations when using KOMPSAT-1 data. Commercial and overseas users can purchase KOMPSAT-1 data from KAI, the marketing agency for KOMPSAT-1 data. KAI receives KOMPSAT-1 data from KARI and sells the data to domestic commercial and private users as well as to overseas users. There are now 79 government and public organizations, institutions and universities registered for public and research use.

15. The Republic of Korea carried out an investigation to look into the fields of data application for users during the periods of testing and regular distribution over eight months. Users utilize KOMPSAT-1 data in various different fields depending on the payload. The table below summarizes the users' fields of application. EOC has been applied to land cover classification and cartography, while OSMI has been utilized for calibration/validation of data, atmospheric correction and oceanography.

Table
Users' fields of application of KOMPSAT-1 data based on payloads

Payload	*Data application fields*
Electro-optical camera	Remote sensing, for applications including cartography, analysis of topography, national territory utilization and management, coastal management, disaster monitoring and prevention, environmental monitoring, ocean monitoring, geographical and Earth physics, utilization of agriculture and forestry, development of water resources, development of land and development of software
Ocean scanning multi-spectral imager	Remote sensing, for applications including environmental monitoring, management of coastal zones and harbours, research into ocean currents, vegetation research, development of natural resources, meteorology and software development
Space physics sensor	Research into the ionosphere and the space environment, estimation of the performance of the random access memory and other applications

16. Although KARI distributes stored EOC, OSMI and SPS data in general, it collects and distributes KOMPSAT-1 data with top priority in cases of emergency, including national security emergencies or disasters. During the normal operation of KOMPSAT-1, registered users can acquire KOMPSAT-1 data using the regular procedure.

17. The KOMPSAT Receiving and Processing Station has established an on-line data catalogue search system for KOMPSAT-1 data. Every user of KOMPSAT-1 data can search EOC and OSMI data via the Internet. The catalogue database is maintained by the external browse module server supporting browsing of EOC and OSMI images and related information such as date, time, geographical location, cloud cover and so on. KARI also provides an on-line service for KOMPSAT-1 SPS data. Registered users can acquire SPS data for scientific research and use the file transfer protocol system. KARI is also trying to provide a user-friendly interface system using the World Wide Web and an active server page, which can be made to operate with a simple mouse click.

2. Space science

18. Korean people have a long tradition of celestial observation and searching for the origins of natural phenomena, which have been observed by the astronomical observatory since the fifth century. While it is difficult for most people to understand the benefits from basic science because of its short history, many scientists working in space-related fields in the Republic of Korea are trying to succeed their tradition and to participate in a global effort for the peaceful use of space. Space science research in the Republic of Korea has been carried out by KARI, the Korea Astronomy Observatory, the KAIST Satellite Technology Research Centre and major universities.

19. As satellite and sounding rocket programmes evolved in the 1990s, space science research also became more active in the Republic of Korea. Data analysis of foreign programmes or ground-based observations constitutes a major portion of space science research in the Republic of Korea. The KITSAT series has measured global high-energy particle distribution and the Earth's magnetic fields, while

KOMPSAT-1 carries out global ionospheric measurements as well as high-energy particle experiments. The sounding rocket programmes have also contributed to ionospheric and ozone-layer experiments. This and other research with ultraviolet and X-ray observations is a growing subject for upper atmospheric science and astronomy using satellites and sounding rockets.

20. Space utilization technology and positional astronomy provide information necessary for everyday life and astronomical observation. GPS has already become a popular concept and a differential GPS network is under development as a precise positional reference. Topographic information from the application of GPS will be an additional benefit derived from space technology. Active participation in another international positioning satellite system is being considered.

21. Scientists from the Republic of Korea are now involved in the research programme of the National Aeronautics and Space Administration of the United States to explore international collaboration in space science and applications. One example would encompass participation in the Advanced Cosmic-ray Composition Experiment for the Space Station (ACCESS) on board the International Space Station for cosmic ray research.

United Kingdom of Great Britain and Northern Ireland

Printed information on space activities in the United Kingdom of Great Britain and Northern Ireland will be distributed during the forty-fourth session of the Committee on the Peaceful Uses of Outer Space, from 6 to 15 June 2001.

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General Assembly

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Committee on the Peaceful Uses of Outer Space

International cooperation in the peaceful uses of outer space: activities of Member States

Note by the Secretariat*

Addendum

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* The present document contains replies received from Member States between 17 January and 13 February 2001.

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I. Introduction

1. In the report on its forty-third session,[1] the Committee on the Peaceful Uses of Outer Space agreed that the Scientific and Technical Subcommittee should consider an agenda item entitled "General exchange of views and introduction to reports submitted on national activities". In its resolution 54/67, of 6 December 1999, the General Assembly endorsed the recommendation of the Committee[2] that the Secretariat invite Member States to submit annual reports on their space activities. In addition to information on national and international space programmes, the reports could include information on spin-off benefits of space activities and other topics requested by the Committee and its subsidiary bodies.

2. Information received from Member States as at 30 November 2000 is contained in document A/AC.105/752. Information received from Member States between 1 December 2000 and 16 January 2001 is contained in document A/AC.105/752/Add.1. The present document contains information received from Member States between 17 January and 13 February 2001.

II. Replies received from Member States

Austria

[Original: English]

Information on Austrian space activities has been published in the Austrian report to the Committee on Space Research (COSPAR), issued on the occasion of the thirty-third Scientific Assembly of COSPAR, held in Warsaw in 2000. The document is available on the Internet home page of the Austrian Space Agency (http://www.asaspace.at/download/COSPAR2000.PDF).

France

[Original: French]

1. This note sets forth the most significant new developments that have taken place since the end of 1999. It should be read in conjunction with the report by the Centre national d'études spatiales (CNES) on its activities in 1999. It also deals with the activities of France in the industrial and commercial fields.

1. Centre national d'études spatiales

2. At the strategic level, one of the priorities of CNES is research into new applications and their promotion, in the framework of diversified partnerships and in close liaison with the scientific community, along with the preparation of three major programmes: Galileo, Pleiades (with Global Monitoring for Environment and Security (GMES)) and the return of samples from Mars.

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[1] *Official Records of the General Assembly, Fifty-fifth Session, Supplement No. 20* (A/55/20), para. 119.

[2] Ibid., *Fifty-fourth Session, Supplement No. 20 and corrigendum* (A/54/20 and Corr.1), para. 119.

(a) Major programmes

Galileo

3. In June 1999, Europe decided to acquire an independent satellite-based navigation system, known as Galileo, designed to be compatible and interoperable with the Global Positioning System (GPS) of the United States of America and the Global Navigation Satellite System (GLONASS) of the Russian Federation. Galileo is also expected to offer uniform quality of service in every respect, even in northern latitudes; a link is to be established between Galileo and the European Geostationary Navigation Overlay Service (EGNOS) to take account of, inter alia, the needs of civil aviation; the quality and continuity of the service are to be guaranteed. At the meeting of the council of ministers of transport held on 21 December 2000, the member States of the European Union agreed to extend the deadline for completion of the system definition studies, which should be ready at the end of 2001.

Earth observation system

4. The need for a European multi-sensor observation system was confirmed by the studies carried out during the preliminary phase and the discussions held between France and Italy to link the Italian Cosmo-Skymed project and the French Pléiades project. The system will comprise six satellites: four x-band radar satellites (to be launched between 2003 and 2005) and two high-resolution optical satellites (to be launched between 2005 and the end of 2006). The system should thus be fully in place in 2007. It will be particularly useful for applications in cartography (land use, environment, town planning and telecommunications), seismic and volcanic risks, hydrology and floods, forestry (forest production, forest protection), geological prospecting, and agriculture (precision agriculture, agricultural statistics and monitoring implementation of agricultural policies) and for marine applications. A cooperation agreement with Italy was signed in January 2001. The prime contractor for the optical component will be French and that for the radar component will be Italian.

5. Questions of environmental security are assuming increasing importance in European Union policies. In response to this trend, in 1998 various European space agencies and organizations, including CNES, in association with the European Commission, launched the GMES initiative. Its objective is to help policy makers meet the challenges posed by environment and security issues, in particular with a view to ensuring the welfare of the population. The initiative comprises three components:

(a) *Global change*. The aim is to assist in the negotiation of international agreements and to facilitate monitoring of their implementation;

(b) *Environmental stress*. This is concerned with management of the adverse consequences of the depletion and degradation of natural resources, particularly water;

(c) *Risks*. This will be of assistance in the prevention and, especially, management of natural and industrial disasters.

6. Space systems, with their global observation capacity and wider scope for practical measures, can of course make a significant contribution to these concerns.

This system offers, for example, a number of observation possibilities, and its technical characteristics (radar and optical satellites) are particularly well suited to the GMES concept. It will also be a useful tool for implementation, by means of the SPOT satellites currently in service and the future SPOT-5, of the Charter on Cooperation to Achieve the Coordinated Use of Space Facilities in the Event of Natural or Technological Disasters, signed in Paris on 20 June 2000 by the European Space Agency (ESA) and CNES. In October 2000 the Canadian Space Agency (CSA) joined this humanitarian initiative, which is intended to promote cooperation between space system operators in the event of natural or technological disasters. It is open to satellite operators worldwide, who must undertake to cooperate on a voluntary basis, without any reciprocal exchange of funds; other organizations and countries have also expressed a keen interest in the initiative. Since 1 November 2000, countries experiencing such disasters have been able to utilize the resources of CNES, ESA and CSA simply by dialling a telephone number. Authorized users will be informed of the telephone number, which is confidential. If a disaster occurs, users will be able to contact an operator at the European Space Research Institute (ESRIN), in Frascati, Italy, who will immediately contact the personnel on call in one of the three space agencies.

Return of samples from Mars

7. The National Aeronautics and Space Administration (NASA) Mars exploration programme includes several missions over the next 10 years, including Mars Odyssey (2001), Mars Exploration Rovers (2003), Mars Reconnaissance Orbiter (2005) and Mars Sample Return (between 2007 and 2014). CNES, too, has embarked on a Mars exploration programme including significant participation in the ESA Mars Express project and definition of the Premier programme (return of samples from Mars and installation of a network for experiments), the two main components of which are:

(a) Participation by France in the NASA sample return programme in the context of its Mars Surveyor programme, with the development and operationalization of the Mars Sample Return mission's Mars orbiter vehicle, the launching of the mission by Ariane 5 and the provision of additional equipment;

(b) Deployment on the surface of Mars of a network of four geophysical landers (Netlander project) developed by a European consortium led by CNES, with Belgian, Finnish and German partners.

8. An important milestone in cooperation between NASA and CNES was reached in October 2000 with the signing of a declaration of intent, recognizing CNES as a major partner in the Mars exploration programme, in the context of the Mars Sample Return mission.

(b) Recent developments in other programmes

Corot

9. Corot, which was agreed in March 2000, is a very-high-precision stellar photometry mission whose objectives are to study the internal structure of the stars and to search for exoplanets (extrasolar planets), in particular, telluric planets. The Corot project uses the Protéus platform. At the scientific and technical levels, it is

being carried out in cooperation with European partners in Austria, Belgium, Italy and Spain. ESA is also involved in the project.

10. The satellite will be placed in an orbit inclined at 90 degrees, at an altitude of 850 km, optimized on the basis of the targets chosen. This orbit will permit continuous observation for more than 150 days of areas of space never occulted by Earth. The launch is scheduled for 2004.

Jason and PICASSO-CENA

11. These two missions use the Protéus platform and are being carried out in cooperation with NASA:

(a) *Jason* is a mission dedicated to satellite observation of the oceans, in particular, to measuring oceanic circulation and determining the marine geoid, as a continuation of the TOPEX-Poseidon mission. The launch is now scheduled for around mid-2001;

(b) *PICASSO-CENA* is dedicated to studying the climatology of clouds and aerosols to measure their impact on the Earth radiation budget. NASA is responsible for providing the payload, and CNES is providing the platform and is responsible for the design base, validation and integration of the satellite. The transition to phases C and D is under way and the satellite is due to be launched in mid-2003.

Megha-Tropiques

12. The main applications of the Megha-Tropiques mission relate to seasonal variations in the water cycle and energy exchanges within the land-ocean-atmosphere system in tropical zones. It is a scientific satellite designed for simultaneous observation of water vapour, clouds, precipitation and radiation in the intertropical region. A cooperation agreement between the Indian Space Research Organization (ISRO) and CNES was signed in November 1999. This satellite, which will use a Proteus platform, is scheduled to be launched in 2005 by the Indian Polar Satellite Launch Vehicle (PSLV).

Microsatellites

13. Conscious of the potential of microsatellites, CNES is offering the scientific and technological community an entirely new line of products, reflecting the fact that microsatellites play a valuable role in promoting innovation at the programme, system, technological and methodological levels. This line of products is characterized by high performance in terms of payload capacities (mass, power, fine pointing, telemetry and processing). It respects the goal of cost reduction, through the use of commercial components and innovations in the areas of risk management, quality control, client-supplier relations and standardization of design and assembly tools. It will be qualified at the end of 2001 and validated during the DEMETER mission planned for 2002. The purpose of that mission is to measure disturbances in the terrestrial ionosphere associated with seismic and volcanic activity. Partnerships with industry are envisaged and, looking beyond the first applications, industrial organization should be prepared to take over production and marketing. CNES will concentrate on its leading role in developing systems and satellites for its own scientific or technological applications or for cooperation programmes.

2. The industrial and commercial sector

(a) Alcatel Space Industries

14. The year 2000 saw a marked recovery in orders for geostationary telecommunications satellites placed with Alcatel Space: 10 satellites were ordered, including 6 satellites based on the latest generation of the Spacebus 4000 platform for the United States telecommunications operator GE Americom; and Syracuse 3, the successor to Syracuse 2, was ordered by the Délégation Générale pour l'Armement of the French Ministry of Defence.

15. A number of satellites produced by Alcatel Space were launched, including the second satellite for the WorldSpace global satellite broadcasting system, Europe*Star, a broadcasting satellite for Europe*Star Ltd., a joint company involving Alcatel Space and Loral Space and Communication, the EUTELSAT W satellite series for the European Telecommunications Satellite Organization (EUTELSAT), and the ongoing renewal of the ExpressA domestic satellite fleet of the Russian Federation.

16. There have been important achievements in the sphere of observation and study of the environment by satellite. With the continued integration of the Meteosat Second Generation (MSG) satellites, for which Alcatel Space is the prime contractor, this is now the first flight model currently operational for a launch. The Jason satellite, a joint NASA/CNES mission, is also in the final phase of integration for a launch in mid-2001. It will take over from the TOPEX Poseidon satellite in space oceanography research.

17. The year 2000 also marked an important stage in the implementation of the European Galileo satellite-based navigation and location project. A major player and prime mover in the Galileo Industries industrial consortium that brings together Alcatel Space (France), Astrium Ltd. (United Kingdom of Great Britain and Northern Ireland), Astrium GmbH (Germany) and Alenia Spazio (Italy), Alcatel Space is responsible for the preliminary research into the global architecture of the system.

(b) Arianespace

18. Arianespace, the world's first commercial space transport company, was established in 1980 to produce and market the Ariane launcher. Shareholders in the company include CNES, the major European industrial players in the sector and several banks. Since then, coordination between ESA, which finances developments, CNES, the prime contractor, European industry, which produces the launcher elements, and Arianespace, which is responsible for coordinating production, commercial activity and launching operations, has been tried and tested. Arianespace has established itself as the world leader in telecommunication satellite launches.

19. Arianespace vehicles are launched from Kourou, Europe's spaceport, which, at lat. 5.3° N, is ideally located for geostationary launches.

20. The reliability and flexibility that have accounted for the success of the Ariane 4 launcher, which will be available until 2003, are also recognized qualities of the new Ariane 5 launcher, which in 2000 proved itself totally operational. During 2000, Arianespace carried out 12 launches (8 with Ariane 4 and 4 with

Ariane 5), out of a total of 16 satellites placed in orbit. At the commercial level, Arianespace secured 16 of the 29 contracts tendered on the world market.

21. With the first new-generation launcher available on the market, Arianespace has several years' head start on its competitors. The European company will adapt its new launcher to developments in demand, particularly in response to the increase in satellite mass. Ariane 5 is to increase its lift capacity from a current level of 6.3 tons to 10 tons in 2002 (using the new Vulcain 2 engine in the main stage and a cryogenic (ESC/A) or reignitable (ES/V) upper stage) and then to 12 tons in 2005 (using a reignitable cryogenic upper stage and the new Vinci (EC/B) engine).

22. With 139 launchings to its credit and a total of 181 satellites placed in orbit, Arianespace now has 48 contracts on its order book.

(c) Astrium

23. Announced in October 1999, the creation of Astrium, a body bringing together Matra Marconi Space and the space activities of DaimlerChrysler Aerospace, was formalized in May 2000 following clearance by the European Commission. This new company, which benefits from the complementarity and performance of its founding companies, offers a global supply in the space sector and achieved significant commercial successes over the period 1999-2000:

(a) As a world leader in civil and military Earth observation satellites and their associated ground segments (prime contractor for Metop meteorological satellites, SPOT-5 and its high-resolution spectrograph (HRS) instruments and for the ground user segment of the Helios II military programme);

(b) As an international player in scientific programmes (prime contractor for various ESA programmes such as Cluster II, Rosetta or Mars Express and its Beagle 2 lander);

(c) As prime contractor for about 50 communications satellites (civil and military). A number of contracts have confirmed the importance of the Eurostar series, a modular range of telecommunications satellites that includes Nilesat 102, Hot Bird 7, INTELSAT 10-01 and 10-02 and Inmarsat 1-4. The United Kingdom Ministry of Defence has entrusted Astrium with the research for Skynet 5;

(d) As a partner in launcher programmes: the hundredth Ariane 4 equipment compartment has been delivered, and the first launching for Eurockot, a 51 per cent owned subsidiary of Astrium, has been carried out;

(e) As lead European contractor for orbital infrastructure programmes, Astrium is a specialist in avionics and on-board informatics and is heavily involved in the systems development of the International Space Station (Columbus laboratory, automated transfer vehicle (ATV), rendezvous subsystem);

(f) As main partner in the design and development of the European satellite-based navigation system, as a 50 per cent shareholder in Galileo Industries SA.

(d) CLS Argos

24. The year 2000 was marked by:

(a) Substantial growth in scientific activity utilizing Argos, with, in particular, the deployment of drifting buoys and the launching of the Argos programme (measurement of temperature and salinity profiles);

(b) Considerable use of the Argos system for management of fishing fleets in Peru, the Russian Federation and the United States and elsewhere, and promising contacts for 2001 in south-east Asia.

25. In 2000, CLS positioned more than 8,000 Argos transmitters.

26. In addition, intensive preparation of future Envisat and Jason launchers resulted in the operational implementation of a ground segment dedicated to precision altimetry and orbitography (Salto). This system has been operational since December 2000.

27. With a view to continued diversification of activities, it was decided to develop a Novacom multi-satellite data communication platform, which will become operational in the summer of 2001.

28. Lastly, CLS continues to operate the International Search and Rescue Satellite System (COSPAS-SARSAT) for the Ministry of Transport and to detect distress calls transmitted through that system.

(e) EADS Launch Vehicles

29. EADS Launch Vehicles, formerly Aerospatiale Matra Lanceurs, a wholly owned subsidiary of European Aeronautics, Defence and Space Company n.v., has now inherited the group's 40 years' experience of launchers and acts as industrial architect and stage developer of launchers of the Ariane family and as space equipment supplier.

30. In December 1999, the company took an order for 20 Ariane 5 launchers in two new versions (ESC-A and ES V), the development of which is continuing with a view to delivery in the near future. Eleven Ariane 4 launchers were delivered in 2000, including the hundredth flight model, as well as the first three Ariane 5 launchers for commercial launches.

31. EADS Launch Vehicles continues to provide support to its subsidiary Starsem for Soyuz commercial flights, with upgrading of facilities, construction of payload dispensers for the Globalstar and Cluster programmes, and assistance in the preparation of the new Soyuz-Fregat version. As prime contractor for ATV, which is one of Europe's major contributions to the International Space Station, EADS Launch Vehicles is continuing its development in a European framework. The project design review took place in mid-2000. In view of its expertise in the field of atmospheric re-entry, EADS Launch Vehicles will be responsible for the heat shield and heat protection of the Beagle 2 probe, which is due to land on Mars in 2003 as part of the Mars Express mission.

32. Activities concerning satellite equipment are developing, with a three-year agreement with Alcatel Space Industries to build antennas and structural elements in composite materials.

(f) Snecma

33. Snecma Moteurs, which in 1999 brought the activities of Société européenne de propulsion, within its Rocket Engine Division, is the leading European company in the field of space propulsion. Its civil activities are centred on the Ariane 4 and Ariane 5 launchers, for which it is the prime propulsion contractor.

34. Following Ariane 5's first commercial flight in December 1999, this launcher confirmed its technical success and commercial uses during 2000. Snecma Moteurs continued its productivity efforts, at the same time preparing to wind up production of Ariane 4, now scheduled for 2003.

35. In order continuously to adapt the European launcher to market requirements, work has continued on developing the Vulcain 2 engine. The first launch under the Ariane 5 Evolution programme is planned for May 2002.

36. Those same requirements already necessitate the preparation of the more powerful Ariane 5 Plus version, agreed at the ESA Council meeting at the ministerial level held in June 1999. Work has begun on the initial development phases of Vinci, the new upper-stage reignitable cryogenic engine. The year 2000 also saw the first functioning in flight of the carbon-carbon extendable nozzle supplied by Snecma Moteurs and Pratt and Whitney, which manufactures the Delta III's RL10 launcher. The result was fully satisfactory.

37. The ESA P80 technology demonstrator programme, preparing for the development of the Ariane 5 boosters and the first stage of the Vega launcher, was agreed in December 2000. Lastly, 2000 was marked by a very significant take-off in the market for plasma propulsion engines for telecommunications satellites. Snecma Moteurs is at the vanguard of this new market.

(g) Spot Image

38. The year 2000 was a turning point for Spot Image, marked by the preparations for the launch of SPOT-5, planned for early 2002, and by the expected arrival of the Orbview 3 and 4 high-resolution satellites (mid-2001), under an agreement with Orbimage. The ground segments of these new satellites are being deployed according to schedule, and the switchover of Spot data reception to a lightweight antenna situated on the Spot Image site has taken place.

39. The SPOT-1, SPOT-2 and SPOT-4 satellites have continued to function normally. More than 8 million scenes have now been archived.

40. Product assembly times and programming performance have been improved, and new systems commissioned: digital archiving, a new Sirius on-line catalogue and commercial and production management systems.

41. A plan of action has been implemented to draw attention to the advantages of the Spot system (archiving and programming), inter alia, through a new price incentives policy, and to extend the range of products and services. In the framework of the Sarcom consortium, for instance, Spot Image has signed an agreement with ESA for world distribution of European Remote Sensing Satellite (ERS) and Envisat data, and has renewed its distribution contract with RADARSAT International. Marketing of vegetation data is in progress. Lastly, direct market

presence has been enhanced, with the opening of an office in Berlin and preparations for the opening of an office in the United Kingdom.

Poland

[Original: English]

1. Organization of the Scientific Assembly of the Committee on Space Research

1. The main event for the Polish space community in the year 2000 was the 33rd Scientific Assembly of the Committee on Space Research (COSPAR), organized locally by the Polish Academy of Sciences and Warsaw University of Technology under the patronage of the President of Poland, Aleksander Kwaśniewski. The Assembly was held at the University from 16 to 23 July.

2. The local organizing committee was chaired by J. Zielinski. K. Stepien was a chairman of the scientific programme committee.

3. The number of participants at the Assembly was 1,681. The number of oral presentations was over 1,700; poster presentations numbered about 700.

4. Polish scientists presented 133 papers and organized the following scientific symposia: "The Copernican Principle and the Homogeneity of the Universe" (Marek Demiański); "Dusty Plasmas and Active Experiments" (Zbigniew Kłos); "Cratering of Icy Surfaces" (Jacek Leliwa Kopystyński); and "X-ray and Gamma-ray Signatures of Black Holes and Weakly Magnetized Neutron Stars" (Andrzej A. Zdziarski). Three Polish scientists were members of the scientific committees of another three symposia.

5. The special session entitled "SPACE 2000: the European Perspective" was organized by the Committee on Space Research of the Polish Academy of Sciences and the European Space Agency (ESA). This session was devoted to the presentation of the European Space Programme. Another special session, entitled "The Next Century of Space Research", was devoted to the national space programmes in seven countries: China, France, India, Japan, Russian Federation, Ukraine and United States of America.

2. Polish Space Office

6. The Prime Minister of Poland established on 28 November 2000 the Polish Space Office, a consulting and coordinating body. The Office is comprised of representatives of several government ministries, governmental agencies and the Polish Academy of Sciences. The Academy is also responsible for the administrative services of the Office.

3. Space physics in Poland in 2000

7. In 2000, Polish activities in space physics continued in the following fields:

(a) Participation in space missions;

(b) Design and construction of scientific equipment for future experiments in space physics;

(c) Processing of data obtained from previous and current space experiments;

(d) Theoretical investigations and interpretation of observational results in the field of space physics.

(a) Space mission

8. The main space project in which Polish physicists were engaged for recent years was INTERBALL, an international multi-satellite mission operated by the Russian Aviation and Space Agency and the Space Research Institute in Moscow, aimed at studying the terrestrial magnetosphere and the transfer of energy from the solar wind into the auroral magnetosphere. From all four satellites of this project, launched in 1995 and 1996, only Tail Probe is still alive and continuously providing new data. INTERBALL finished its work in October 2000.

9. Polish scientists have participated in four experiments of this mission:

(a) Two experiments on Tail Probe: ASPI, to measure the plasma waves and electromagnetic fields along the spacecraft orbit; and the solar X-ray thomograph-photometer RF-15-1 (constructed in cooperation with Czech scientists);

(b) One experiment on the sub-satellite Magion 4 of Tail Probe: SAS, the plasma wave spectrum analyser;

(c) One experiment on the Auroral Probe: POLRAD, the radio-spectro-polarimeter to measure the electromagnetic Auroral Kilometric Radiation.

10. The main efforts of Polish laboratories are now focused on the digital processing and physical analysis of a good deal of observational data analysis from these instruments, in cooperation with partners from other countries. Polish engineers have made a considerable contribution to the development of instrumentation for all of those purposes.

(b) Hardware for future experiments

11. Instrumentation for several future international space projects continues to be developed in Poland, mostly in the Space Research Centre of the Polish Academy of Sciences. Poland has contributed to the development of the following:

(a) In the CORONAS-F project (coordinated by the Russian Federation); Poland finished construction and tests (in cooperation with the Rutherford-Appleton Laboratory of the United Kingdom of Great Britain and Northern Ireland) of the solar X-ray photometer RESIK;

(b) In the Cassini mission of ESA and the National Aeronautics and Space Administration (NASA), launched in October 1997, the THP sensor (thermal property meter), built in Poland as part of a British Surface Science Package (SSP) experiment, was installed on the lander of the Huygens mission to Titan, one of Saturn's moons, to measure temperature and thermal conductivity of gases and liquids in Titan's atmosphere and ocean;

(c) In the International Gamma-Ray Astrophysics Laboratory (INTEGRAL) project, devoted to measuring X-ray and gamma-ray deep-space sources, Poland contributed to the development of:

(i) The gamma imager IBIS (construction of the veto electronics system);

(ii) The tests and integration of the main detector of the SPI spectrometer;

(iii) The X-ray monitor JEM-X (construction of the ground support electronics);and

(iv) The software in the INTEGRAL Science Data Centre;

(d) In the ROSETTA mission to the comet P/Wirtanen, Poland contributed to the MUPUS experiment, in particular the development of the penetrator PEN/MUPUS to measure the density, temperature, thermal conductivity and mechanical properties of the cometary nucleus; the laboratory model has been constructed;

(e) In the French DEMETER project, aimed at studying electric phenomena in the ionosphere stimulated by earthquakes, Poland contributed to the plasma wave experiment;

(f) In the Mars Express project, Poland is contributing to the study of the Mars environment and Martian dust properties.

(c) Data processing and interpretation

12. Most of the following Polish contributions to the processing and analysis of space data have been described in international journals:

(a) Analysis of data obtained from ASPI (INTERBALL-1) and SAS (sub-satellite of INTERBALL-1);

(b) Analysis of data from the solar X-ray spectrometer aboard INTERBALL-1;

(c) Analysis of data on the Auroral Kilometric Radiation from POLRAD (INTERBALL-2);

(d) Continue data analysis from the SORS-D experiment on electromagnetic wide-band disturbances (CORONAS);

(e) Cooperation in the analysis of the solar X-ray Yohkoh data, for investigations of flare heating, plasma motions in flares and the chemical composition of flare plasma;

(f) Data processing and interpretation of the Ulysses Gas experiment on the distribution of interstellar helium.

4. Satellite geodesy in Poland in 2000

13. The following institutions took part in cooperation in the field of planetary geodesy:

(a) Space Research Centre of the Polish Academy of Sciences;

(b) Warsaw University of Technology;

(c) University of Olsztyn;

(d) University of Poznan;

(e) Kraków Academy of Mining and Metallurgy;

(f) Institute of Geodesy and Cartography;

(g) Wroclaw Academy of Cartography.

14. The main activities were:

(a) Participation in the COSPAR Scientific Assembly:

(i) Number of authors or co-authors of papers: 24;

(ii) Number of papers presented: 17;

(b) Organization of the Millennium Meeting Poland-Italy, held in Krakow from 29 June to 1 July 2000 (5 sessions, 5 chairpersons):

(i) Number of authors: 12;

(ii) Number of papers presented: 8.

15. The topics of research in 2000 were as follows:

(a) Application of Global Positioning System (GPS) techniques in aviation;

(b) Land application of GPS: three permanent stations of the International GPS Service (IGS) for Geodynamics and six permanent reference GPS stations of the Subcommission for Europe of the IAG Commission X on Global and Regional Geodetic Networks (EUREF) are operating in Borowiec, Borowa Gora, Gdansk, Jozefoslaw, Lamkowko and Wroclaw;

(c) Application of GPS to research of the ionosphere;

(d) GPS road survey along the Terespol-Rzepin railroad track;

(e) Establishment of a differential GPS (DGPS) and real-time kinematic (RTK) permanent station in the Gdansk-Sopot-Gdynia area;

(f) DGPS surveys in Bialowieza National Park;

(g) Maritime GPS applications:

(i) Two reference GPS beacons in Rozewie and Dziwnow are operating;

(ii) RTK GPS in the Gdansk shipyard;

(iii) RTK DGPS for monitoring the capabilities of ship manoeuvres;

(h) Application of GPS in geodetic and geodynamics programmes in Central European Initiative (CEI) countries: the Central Europe Regional Geodynamics Project (CERGOP), the Tatry mountains, the Sudety mountains;

(i) Participation in international symposia and conferences of the International Association of Geodesy (IAG), the European Geophysics Society (EGS) and the global navigation satellite system (GNSS).

5. Remote sensing and Geographic Information System activities in Poland in 2000

16. Three research centres were the main contributors to remote sensing/Geographic Information System (GIS) activities in Poland:

(a) Remote Sensing and Spatial Information Centre of the Institute of Geodesy and Cartography in Warsaw;

(b) Department of Satellite Studies at the Institute of Meteorology and Water Management in Krakow;

(c) Department of Remote Sensing of the Environment of the Faculty of Geography and Regional Studies at the University of Warsaw.

17. Activities of the Remote Sensing and Spatial Information Centre were concentrated on land applications of satellite data. In particular, special emphasis was placed on the development and operational use of a remote-sensing-based system for crop condition assessment and yield forecasting. The following activities were carried out in the Centre in 2000:

(a) Daily National Oceanic and Atmospheric Administration (NOAA) Advanced Very High Resolution Radiometer (AVHRR) satellite data on Poland were acquired for the year 2000;

(b) A NOAA/AVHRR archival database, covering the period 1992-2000, was created for all of Poland;

(c) An INFOSAT database, containing vegetation and temperature indices derived from NOA/AAVHRR data, was built for the period 1992-2000;

(d) Information packages on crop condition assessment, containing maps and images derived from comparative analysis of NOAA/AVHRR data, were operationally delivered to the Central Statistical Office throughout the vegetation period;

(e) A model for the evaluation of soil-plant relations, based on the analysis of radar satellite images collected in the C and L bands, was prepared;

(f) A method for correcting microwave data for terrain relief was prepared;

(g) A method for assessing soil moisture using information derived from European remote sensing satellite (ERS) data was created;

(h) Satellite image maps, produced from high-resolution Indian Remote Sensing Satellite (IRS-1C) data, were prepared for selected regions of Poland.

18. The Department of Satellite Studies at the Institute of Meteorology and Water Management conducted in 2000 the following activities:

(a) The operational acquisition of METEOSAT and NOAA data for meteorological purposes was continued;

(b) A database of meteorological satellite images was created for the period 1996-2000;

(c) A method for determining rainfall intensity using Advanced Microwave Sounding Unit (AMSU)/NOAA data, was prepared;

(d) Software for accessing data on the sounding of the atmosphere via the Internet was prepared;

(e) A method for estimating surface radiation using METEOSAT data was tested;

(f) Work on forecasting ultraviolet-B radiation on the Earth's surface was continued.

19. The Department of Satellite Studies was deeply involved in activities within EUMETSAT, an organization that Poland had joined in December 1999.

20. The Department of Remote Sensing of the Environment at the University of Warsaw was mainly involved in the work concerning the application of multisource satellite data and aerial images in the assessment of environmental changes in Poland, apart from its educational function within the Faculty of Geography and Regional Studies.

21. At the COSPAR Scientific Assembly held in Warsaw in June and July 2000, the Remote Sensing Centre and Department of Satellite Studies made major contributions to the discussions on remote sensing. In November 2000, the National Conference of Photo-interpretation and Remote Sensing was organized by the Department of Remote Sensing of the Environment of the University of Warsaw; papers were presented by representatives of the leading remote sensing centres in Poland. Five research projects were submitted by the Remote Sensing and Spatial Information Centre to the latest version of the European Commission's Fifth Framework Programme for Research and Technological Development (1998-2002).

6. Space medicine and biology in Poland in 2000

22. In the field of aerospace medicine, experiments have been conducted using the lower body negative pressure (LBNP) model for the assessment of physiological responses of the human organism influencing acceleration tolerance. Those experiments should lead to the development of methods that will make it possible to predict the effectiveness of compensating mechanisms important for the high-G environment, similar to entering Earth gravity after a long period of weightlessness.

23. Comparing G-tolerance measured on human centrifuge with some haemodynamic parameters during LBNP protocol, statistically significant correlation was found, particularly in cardiac output (CO), pre-ejection period (PEP) and left ventricular ejection time (LVET). Previous studies had shown similar correlation with renin and aldosterone concentration.

24. Investigations are being carried out to establish the factors that contribute most to high acceleration tolerance.

25. Other experiments included evaluating the physical training of muscular strength on acceleration tolerance. It was shown that the selective training of particular muscle groups has little effect on increasing G-tolerance among young people. There was statistically significant correlation between maximal muscle strength of lower extremity protractors measured in the sitting position and G-tolerance. These experiments will lead to the development of specialized isometric training.

26. Some studies carried out on otherwise healthy persons, who had been immobilized as a result of fractures in their lower extremities, showed that they had decreased activity of copper-zinc superoxide dismutase (Cu ZnSOD) in erythrocytes on days 5, 12, 19, 26 and 40 of immobilization (maximally at day 12), decreased catalase activity during the entire immobilization, decreased activity of glutathione peroxidase on day 5 and increased concentration of lipid peroxides (TBARS) after 5, 12, 19, 26 and 40 days of immobilization. Blood platelet activity of Cu ZnSOD, glutathione peroxydase and catalase were significantly decreased after 14 and 28 days of immobilization; later there was a tendency for normalization of all parameters studied after 90 days. The results should help in monitoring the proper amount of physical activity among astronauts.

27. A study was carried out on the effects of short-term bed rest on physiological responses to glucose ingestion, graded exercise, changing position and hand cooling in sedentary and trained subjects. It was demonstrated that remaining in supine position for only a few days could markedly modify responses to various physiological stimuli. The effects of bed rest depend on the level and kind of previous physical activity. Carbohydrate tolerance is more affected in sedentary than in fit subjects, while changes in exercise tolerance, sympathetic and hormonal responses to the physiological stimuli are most pronounced in subjects trained for endurance. The study also proved that short-term bed rest diminishes the basal activity of the sympathetic nervous system, but the responses of this system are depressed only if the stimuli affect baroreceptors.

28. There are also interesting findings on the effects of acute and chronic muscle unloading in rats. The effects of acute and prolonged hindlimb suspension on insulin-stimulated glucose utilization by the rat skeletal muscle were studied in vitro. Hindlimb suspension was found to enhance basal glucose transport, lactate production and glycogen synthesis. An increase in the sensitivity of these processes to insulin occurred as early as 24 hours and persisted for five weeks during muscle unloading. The data do not support the concept that enhanced glucose utilization and improved muscle insulin sensitivity during hindlimb suspension are related to muscle atrophy, since atrophy does not occur in the early stage of muscle unweighting.

Saudi Arabia

[Original: English]

1. In recognition of space technology advancement and its various applications in support of mankind, Saudi Arabia has initiated numerous directives in an effort to benefit from this technology's peaceful applications.

2. An initiative in this direction is the recent establishment of the Space Research Institute at King Abdulaziz City for Science and Technology in support of space technology transfer, development and adaptation. Saudi Arabia's initiative is also complemented by nationwide awareness and the involvement of the public and private sectors, especially in telecommunications, communications and information, meteorology and remote sensing.

1. Telecommunications

3. Saudi Arabia is an active member of the International Telecommunication Union (ITU). It is also a permanent member of the World Administrative Radio Conference (WARC), now the World Radiocommunication Conference (WRC), and presided over WARC-95. Saudi Arabia maintains a close relationship with national and international organizations in the field, such as the Arab Satellite Communications Organization (ARABSAT), the International Telecommunications Satellite Organization (INTELSAT) and the International Mobile Satellite Organization (IMSO).

4. Recently, Saudi Arabia initiated and supported the privatization of its leading telecommunication organization, thereby establishing the Saudi Telecommunication Company (STC) as the main provider of telecommunication services and other commercial services. This undertaking underlines the long-term private sector involvement and investment.

2. Broadcasting

5. In addition to the State-owned radio and television services, Saudi Arabia has supported the establishment of other privately owned and operated services of that kind. The coverage of both services includes the Middle East and extends to many regions worldwide via multi-satellite networks. The State-owned services have been broadcasting to many regions worldwide via ARABSAT.

6. Plans for the near future include making these services, including the Saudi News Agency, available through the Internet.

3. Environmental protection

7. In 1966, the Meteorological and Environment Protection Administration (MEPA) joined the World Meteorological Organization (WMO). In 1981, MEPA became the national organization in charge of environmental protection.

8. MEPA is considered a major regional weather monitoring centre in terms of its staffing and facilities; as a result, MEPA was selected by WMO as the regional centre. In 1990, the Ministerial Committee on the Environment was formed to legislate environmental policies and strategies and, further, to formulate the directives of Saudi Arabia on regional and international environmental issues.

4. Remote sensing

9. Remote sensing technology and its applications have been quickly advancing in recent years. Such advances include improved spectral and spatial resolutions, as well as high data delivery rate and frequency of revisits. This has led to an increased number of applied projects and advanced research activities in Earth observation and the study of Earth resources.

10. In recognition of the viability of this technology, the Saudi Centre for Remote Sensing (SCRS) was established in 1986 as a division of the Space Research Institute. The responsibilities of SCRS include data reception and distribution to various users, promoting the use of satellite data and building a rich data archive. In support of this effort, SCRS signed a number of agreements to receive satellite data from various satellites. Currently, SCRS receives and distributes satellite images

from the Land Remote Sensing Satellite (Landsat), SPOT-1, SPOT-2 and SPOT-4, RADARSAT, the Indian Remote Sensing Satellite (IRS-1C and IRS-1D) and National Oceanic and Atmospheric Administration (NOAA) satellites. The coverage area of the SCRS reception ground station extends to a radius of 2,700 km, with about 23 million km^2 of surface area coverage. The ground station is capable of simultaneously receiving multiple satellites and it is fully automated for satellite tracking reception. With the recent upgrading of its reception and image analysis and processing capabilities, SCRS is now considered one of the leading centres worldwide.

5. Satellite technology

11. Saudi Arabia established the Space Research Institute at King Abdulaziz City for Science and Technology to develop capabilities in the area of space technology. On 26 September 2000, two microsatellites, SaudiSat 1A and 1B, developed and built by the Space Research Institute, were launched successfully by a Russian launcher.

United States of America

[Original: English]

1. The United States of America has provided the text below in response to the request for information on the space activities of Member States, made by the Secretary-General on 26 July 2000. The information presented here is focused on scientific achievements announced in the area of Earth science and on remote sensing applications activities conducted over the last year. This information is supplemental to the annual United States *Aeronautics and Space Report of the President*, which, due to this year's production schedule, will be made available to the Committee on the Peaceful Uses of Outer Space at a later date. For those delegations interested in reviewing this report in advance of its distribution, it can be found on the Internet (http://history.nasa.gov/presrep99/home.html).

2. With respect to scientific discoveries, the United States announced over the past year many scientific discoveries and findings using Earth remote sensing data, only some of which are described here. For example, the National Aeronautics and Space Administration (NASA) announced last autumn that less climate cooling from clouds may be expected, given new research results. Some climate theories predict that a warmer atmosphere would evaporate more water, and this additional water vapour would form thicker clouds, contributing to future cooling. However, NASA research has found that when air temperatures are higher, clouds become thinner and are thus less capable of reflecting sunlight. Continued research with improved observations from Earth Observing System (EOS)-Terra and other next-generation satellites, together with modelling studies at NASA, National Oceanic and Atmospheric Administration (NOAA) and National Science Foundation (NSF) laboratories and centres (among others), will refine the estimates of the future effects and impacts of global climate change in support of the Intergovernmental

Panel on Climate Change and the United Nations Framework Convention on Climate Change.[3]

3. In September 2000, scientists revealed that a NASA spectrometer had detected an Antarctic ozone "hole" (what scientists call an "ozone depletion area") that was three times larger than the entire land mass of the United States, nearly 18 million km^2, the largest such area ever observed. Although production of ozone-destroying gases has been curtailed under international agreements, concentrations of the gases in the stratosphere are only now reaching their peak. NASA scientists also announced last year that the ozone layer may not recover from the damage over the Arctic region as quickly as scientists had previously thought. According to the new findings, more polar stratospheric clouds than anticipated are forming high above the North Pole, causing additional ozone loss in the sky over the Arctic. Polar stratospheric clouds are a concern, of course, as they provide the surfaces that convert benign forms of chlorine into reactive, ozone-destroying forms, and they remove nitrogen compounds that act to moderate the destructive impact of chlorine. From what we know now, it may be many decades before the ozone hole is no longer an annual occurrence. Using data from the NASA Total Ozone Mapping Spectrometer (TOMS) and NOAA Solar Backscatter Ultraviolet (SBUV/2) instruments, scientists are continuing to evaluate and monitor the effect of this phenomenon on Earth.

4. With respect to tropical storms, weather forecasters have been given a new way to see through the clouds that often hide these storms and to identify them much faster. According to a new study by researchers from NOAA and NASA, the SeaWinds instrument on board NASA QuikSCAT spacecraft can detect the closed circle of winds that characterize a tropical depression up to 46 hours sooner than conventional means. Being able to detect tropical depressions early is especially important in increasing warning times in regions like the Gulf of Mexico, where hurricanes make landfall within a few days. Early detection also helps national agencies, such as the NOAA National Hurricane Center, to plan the best use of their resources and keep a better watch on developing storms.

5. New research last year also shows that adding rainfall data from the United States/Japan Tropical Rainfall Measuring Mission (TRMM) and other meteorological satellites to forecast models can more than triple the accuracy of short-term rainfall forecasts. For years, scientists have attempted to improve the short-term forecasts in the tropics, but only minor improvements were made. Now, with the research data from the NASA spacecraft, scientists can more accurately forecast rainfall in their regions. Recently, NOAA has commenced using these data to track hurricanes and rainfall accumulations.

6. Finally, mention should be made of this year's release of several stunning images from the EOS-Terra mission. These initial images highlighted global surface temperatures and "spring greening" over the North American continent and showed relationships among population concentrations, air pollution and vegetation over the Indian subcontinent, among others. EOS-Terra includes instruments from Canada and Japan.

[3] United Nations, *Treaty Series*, vol. 1771, No. 30822.

7. Over the last year, the United States has also been involved in a variety of other activities focused on promoting the application and use of satellite remote sensing data and Geographic Information System (GIS) technology to address serious problems faced by people around the world. Whenever possible, these activities have been undertaken for the benefit of developing countries. For example, the United States Geological Survey, NOAA and the United States Agency for International Development (USAID), as part of the USAID Famine Early Warning System (FEWS) programme, organized a workshop entitled "Satellite Rainfall Estimation in Eastern and Southern Africa" in Pretoria, South Africa, in May 2000. The workshop was designed to unite the producers and users of remote sensing rainfall estimate data, since both the monitoring and forecasting of regional droughts, floods and agricultural production depend upon rainfall magnitude and spatial distribution. In a related activity, the United States Geological Survey developed a variety of satellite-based data sets to assess the impact of the failure of the year 2000 "Long Rains", or long rainy season, in Kenya. Satellite rainfall estimates from the FEWS programme were also analysed to assess the impact of drought on the growing season for main staple crops in Kenya. In addition, maps of cumulative rainfall and the onset of rains were used to assess the impact of seasonal rainfall on specific crops such as maize.

8. In another example, the United States Geological Survey used satellite imagery from the Land Remote Sensing Satellite (Landsat) and Canada's RADARSAT, aerial photography and field photos to document the progression of water hyacinth infestation on Lake Victoria in Kenya. The growth of enormous mats of water hyacinth have rendered the port of Kisumu, Kenya, inoperable for a period of time, severely limiting subsistence and commercial fishing and blocking the municipal water intake, resulting in water shortages. These tools provide a means of monitoring the extent of water hyacinth on a seasonal basis across the lake. Cooperators in the region include the Intergovernmental Authority on Development and the regional Lake Victoria Environmental Management Project.

9. With respect to Canada's RADARSAT satellite, NASA and NOAA are also using its C-band synthetic aperture radar (SAR) data for a variety of research and operational applications. NASA is using RADARSAT data for activities such as Antarctic mapping, glacier and sea ice process studies, solid Earth deformation research, soil moisture assessments, flood monitoring, studies of ocean winds, land vegetation and ocean productivity research and more. NOAA is making extensive use of RADARSAT data to support United States National Ice Center charts, forecasts and services. NOAA is also utilizing RADARSAT for severe storm analysis, flood monitoring and fisheries enforcement.

10. The United States has also maintained active involvement in the Committee on Earth Observation Satellites (CEOS). In particular, NOAA chairs the Disaster Management Support Group, which has worked to investigate and demonstrate technical coordination of civil satellite systems in support of disaster management. At the November 2000 CEOS Plenary, the Disaster Management Support Group was tasked to support the International Charter on Space and Major Disasters and provide its full support to the work of the Committee on the Peaceful Uses of Outer Space in pursuit of the recommendations of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III).

11. Currently, the United States Geological Survey, the Nature Conservancy and the International Institute of Tropical Forestry of the United States Department of Agriculture are collaborating to produce vegetation/land-cover maps for the islands of the Caribbean based on Landsat Thematic Mapper satellite images and other remotely sensed data. These maps will provide baseline information for natural resource management and biodiversity protection for the Caribbean countries.

12. With respect to remote sensing use by non-space agencies, the United States Department of Agriculture has been using Earth observation data for over 20 years to provide reliable and timely assessments of global agriculture production, which remains vital to stable international agriculture commodity pricing. The Department also uses remote sensing technology and processes to support and develop in-country agriculture and forestry preservation, safety and productivity and to help farmers worldwide to make informed planting decisions and to improve risk management practices. Furthermore, remote sensing data have played a critical role in enabling the Department to support international disaster aid efforts.

13. The United States is very pleased that, in addition to its successful launches and missions, these and many other scientific and applications successes have been made over the last year, thanks to the availability of Earth remote sensing data. The United States looks forward with enthusiasm to the many new discoveries and innovations that will undoubtedly be made by it and other countries in the years ahead.

United Nations A/AC.105/752/Add.3

General Assembly

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Committee on the Peaceful Uses of Outer Space

International cooperation in the peaceful uses of outer space: activities of Member States

Note by the Secretariat*

Addendum

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* The present document contains information received from Member States between 14 February and 19 April 2001.

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I. Introduction

1. At its fifty-fifth session,[1] the Committee on the Peaceful Uses of Outer Space agreed that the Scientific and Technical Subcommittee should consider an agenda item entitled "General exchange of views and introduction to reports submitted on national activities". In its resolution 54/67 of 6 December 1999, the General Assembly endorsed the recommendation of the Committee[2] that the Secretariat invite Member States to submit annual reports on their space activities. In addition to information on national and international space programmes, the reports could include information on spin-off benefits of space activities and other topics requested by the Committee and its subsidiary bodies.

2. Information received from Member States as at 13 February 2001 is contained in the note by the Secretariat of 4 December 2000 and addenda (A/AC.105/752 and Add.1 and 2). The present document contains information received from Member States between 14 February and 19 April 2001.

II. Replies received from Member States

Canada

1. Canada achieved many accomplishments during 2000, including renewed participation in various international cooperation agreements, improvement of services in disaster management, as well as participation in Mission Endeavour and the installation of solar panels on the International Space Station.

2. The Canadian Space Agency (CSA) has continued to promote global cooperation in the peaceful uses of outer space, to encourage activities with important contributions to the global space knowledge base and to ensure that space science and technology continue to provide social and economic benefits for Canadians and humanity. In pursuit of those objectives, the Canadian space programme focuses on five areas: earth and environment, generic space technologies, space science, satellite communications and human presence in space.

3. The present report describes some of Canada's activities in space during the year 2000.

1. International cooperation

4. In June, CSA renewed its membership in the European Space Agency (ESA) by signing of a 10-year cooperation agreement, in the presence of the Canadian Prime Minister, at ESA headquarters in Paris. The agreement recognizes the long-standing history of cooperation between Canada and its European partners and the socio-economic benefits that come from the mutual promotion of the peaceful development of space science and technology. Working with European firms, Canadian companies are expanding their partnership in Earth observation and satellite navigation and building the next generation of satellites offering clients

[1] *Official Records of the General Assembly, Fifty-fifth Session, Supplement No. 20* (A/55/20), para. 119.

[2] Ibid., *Fifty-fourth Session, Supplement No. 20* (A/54/20), para. 119.

access to faster and cheaper high-speed communications, multimedia and the Internet.

5. In October, CSA also signed a number of new agreements with the National Aeronautics and Space Administration (NASA) of the United States of America that will strengthen the overall NASA/CSA relationship. The agreements involve areas such as scientific satellites, utilization of the Synthetic Aperture Radar Satellite (RADARSAT), and potential collaboration on the exploration of Mars, to name a few. The Administrator of NASA and the President of CSA noted the history of successful cooperation in space between Canada and the United States, reviewed ongoing cooperation between the two agencies and noted their satisfaction with the status of those activities.

2. Earth observation

6. In Earth observation, Canada's RADARSAT-1, launched in 1995, continues to prove its worth to scientists and commercial users alike. The satellite has demonstrated its usefulness in many fields, including disaster management, agriculture, cartography, hydrology, forestry, oceanography, ice studies and mineral and oil exploration.

7. The year also provided new insights into the mysteries of Arctic Sea ice, thanks to the unique abilities of RADARSAT. Using RADARSAT's special sensors to take images at night and to peer through clouds, NASA researchers can now see the complete ice cover of the Arctic. This allows tracking of any shifts and changes, in unprecedented detail, over the course of an entire winter. The radar-generated high-resolution images are up to 100 times better than those taken by previous satellites. The satellite is expected to play an important role in helping scientists monitor Earth's climate shifts.

8. A second mapping of the Antarctic is now under way, with coverage to regions north of about 80° S. The Modified Antarctic Mapping Mission (MAMM) is a collaboration between NASA and CSA to map Antarctica using synthetic aperture radar (SAR). Utilizing RADARSAT-1 fine beams will provide an opportunity to image many of Antarctica's fast glaciers, whose extent was revealed through data collected in 1997, during the first mapping project of the Antarctic. MAMM will also attempt to capture extensive data suitable for unprecedented interferometric analysis of the surface velocity field. The mission will attempt to answer questions about the stability of the Antarctic ice sheet and the response of the ice sheet to changes in climate.

9. In another project, a mosaic of the United States was created through the compilation of 190 high-resolution images captured over the continent. The United States mosaic is part of an ongoing CSA project that has also generated mosaics of Antarctica and Canada. Currently under way is a comprehensive data mapping of Africa, which is projected for completion in 2001.

10. CSA is also supporting the Application Development Research Opportunity-2 (ADRO) programme, which aims at developing innovative approaches and applications for data acquired by RADARSAT-1. ADRO-2 is building bridges between academic researchers and established space-based companies and forging alliances with international partners, enhancing knowledge, expertise and

technologies applied to the growing field of Earth observation. NASA is also participating in the initiative.

3. Space science

11. Progress has been made in the joint United States/Canada Far Ultraviolet Spectroscopic Explorer (FUSE) project. Through participation in the project, CSA has provided two fine-error sensors, which guide and navigate the FUSE to enable it to point in precisely the right direction to make its exacting scientific observations. The project focuses on the study of "hot stars", the massive stars that are responsible for recycling within their host galaxies matter both from stellar winds and supernovae. Results indicate large differences between stars of the same mass in two galaxies. By studying why stars behave differently in different galaxies, understanding may be reached of how the first stars in primeval galaxies began the process of enriching their galaxies and affecting later generations of stars visible today.

12. Scheduled for launch in 2002, SCISAT-1's atmospheric chemistry experiment will study ozone depletion in the atmosphere. SCISAT-1 will improve understanding of the chemical processes that control the distribution of ozone in the Earth's atmosphere, especially at high altitudes, with particular emphasis on the processes occurring over Canada and the Arctic.

13. The Canada/Japan/United States mission to study the Earth's lands, oceans, clouds and atmosphere is producing exciting results. The CSA measurements of pollution in the troposphere (MOPITT), launched on the NASA Terra satellite in 1999, measure "radiances" in the atmosphere to determine the amount of carbon monoxide and methane present. During the five-year mission, MOPITT will continuously scan the atmosphere below it to provide the world with the first long-term, global measurements of carbon monoxide and methane gas levels in the lower atmosphere. The results collected through MOPITT and other instruments will help scientists predict long-term effects of pollution, understand the increase of ozone in the lower atmosphere and guide the evaluation and application of shorter-term pollution controls.

14. CSA, Environment Canada and the Natural Sciences and Engineering Research Council of Canada, in partnership with universities and industry, successfully launched and retrieved the giant research middle-atmosphere nitrogen trend assessment (MANTRA) balloon from Vanscoy, Saskatchewan. This was the second flight of the MANTRA project, the first having taken place in August 1998. The MANTRA research project will help scientists determine the effectiveness of the reduction of ozone-depleting chemicals undertaken since the Montreal Protocol on Substances that Deplete the Ozone Layer, a global agreement to protect the ozone layer. That environmental treaty, adopted in 1987 and since signed by over 160 countries, uses scientific research to set limits for the worldwide production of ozone-depleting substances in order to ensure that ozone levels return to normal and do not become threatened again in the future.

15. 26 February 2000 marked over 160 years of continued Canadian scientific research into the mysteries of the Northern Lights, when the CSA GEODESIC experiment was successfully launched into the Earth's upper atmosphere. The purpose of GEODESIC is to study how the energy deriving from the Northern

Lights warms the high terrestrial atmosphere. The instrument examined small pockets of energy in the Earth's upper atmosphere where the Northern Lights are found. Those pockets can reach temperatures of over 1 million °C, although the reason they exist is still unknown to scientists. Fluctuations in the Northern Lights are believed to have caused widespread power outages on Earth and disruptions of orbiting satellites.

16. The CSA thermal suprathermal analyser (TSA) was successfully launched on 4 December 2000 from Sptizbergen, Norway, on board a Japanese sounding rocket on a scientific mission to learn more about the evolution of the atmosphere. The TSA instrument is designed to analyse the complexities of ion composition and distribution in Earth's upper atmosphere. Measuring and understanding the behaviour of the very lowest energy particles and gases is vital in order to understand the origin and composition of plasma in the Earth's magnetosphere. Greater knowledge of the past and the evolution of the Earth's atmosphere and ionosphere will help scientists discern the planet's history and possibly its future.

17. Following the success of the OSTEO experiment, the Canadian osteoporosis research performed during United States Senator Glenn's return to space in 1998, CSA is now developing follow-up experiments to be conducted on a future space shuttle mission. It is expected that research performed by Senator Glenn may offer the potential of direct health benefits here on Earth.

4. International Space Station

18. While Astronaut Julie Payette was the first Canadian to visit the Space Station in May 1999, Marc Garneau followed in November 2000. Garneau successfully completed his mission, which involved the deployment of solar panels, the main source of power for the International Space Station. He was also assigned the responsibility of monitoring space walks for the STS-97 mission.

19. In March, CSA proudly awarded robotic operator's wings to two NASA astronauts, the first astronauts to obtain the qualification to operate the Space Station remote manipulator system (SSRMS). Astronaut Chris Hadfield will become the first Canadian ever to perform a space walk when he delivers and installs the SSRMS to the Space Station during the STS-100 mission in April 2001.

5. Communications

20. Canada has set up a public private sector partnership to develop and launch a specialized multimedia communications satellite payload. In collaboration with industry, CSA and the Communications Research Centre will develop, deploy and operate an innovative Ka-band high-speed multimedia communications payload. The multimedia payload, a key part of the $600 million ANIK F2 satellite to be launched in 2002, will commercialize the use of the Ka band. The payload offers the promise to deliver cheaper, faster and more highly effective communications services and to expand access to tele-medicine, tele-learning, tele-working, electronic (e)-commerce, high-speed Internet and government services to citizens living in urban, rural and remote communities throughout Canada.

21. Finally, CSA established the John H. Chapman Award, aimed at honouring individuals who have manifested exceptionally innovative qualities for the greater benefit of the Canadian space programme. The first recipient of the award was

John S. MacDonald, in recognition for his exceptional contribution. Mr. MacDonald is co-founder of MacDonald Dettwiler and Associates, a world-class provider of information and operational Earth observation systems. He is widely renowned for his expertise in remote sensing, image processing and maximizing the extraction and use of information coming from remotely collected data.

6. Relevant web addresses

Canadian Space Agency	http://www.space.gc.ca
Canadian Centre for Remote Sensing	http://www.ccrs.nrcan.gc.ca
Communications Research Centre	http://www.crc.doc.ca
Government of Canada	http://canada.gc.ca
Natural Resources Canada	http://nrc.gc.ca

Slovakia

1. The Government of Slovakia has created the Committee for Research and Peaceful Uses of Space as an advisory committee for the Council of the Government of the Slovak Republic for Science and Technology. Its Chairman, Štefan Luby, the President of the Slovak Academy of Science, personally leads the Committee, which is responsible for working at the meetings of the Network of Space Science and Technology Education and Research Institutions for Central Eastern and South-Eastern Europe.

2. The point of contact in Slovakia is:

Prof. Štefan Luby

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